



Town of Arlington
Department of Health and Human Services
Office of the Board of Health

27 Maple Street
Arlington, MA 02476

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Artificial Turf Study Committee Agenda
02/20/24

Meeting Date: February 20, 2024

Meeting Time: 5PM-6:30PM

Location: Zoom

Objectives:

- 1) To hear from subject matter experts on various topics concerning the Health, Safety, and Environmental concerns associated with natural grass and artificial turf fields.
- 2) To discuss the draft bullet reports submitted by each working group

Agenda

- I. Acceptance of Meeting Minutes
- II. Correspondence Received
- III. Guest Speaker (s)
 - a. Ian Lacy, Lead Project Advisor for Tom Irwin
<https://tomirwin.com/about-us/>
- IV. Discussion: Draft Working Group Reports
 - a. Environmental
 - b. Safety
 - c. Health
- V. Discussion: Project Timeline, Deliverables, Reports
- VI. New Business
- VII. Adjourn



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Artificial Turf Study Committee Meeting Minutes

Meeting Date: February 13, 2024

Meeting Time: 5PM-6:30PM

Location: Zoom- Registration link:

<https://town-arlington-ma-us.zoom.us/join/9tZAvCuqoqTssHt1BnuSXOpbXEnysRzAC-LUe>

Objectives:

- 1) To hear from subject matter experts on various topics concerning the Health, Safety, and Environmental concerns associated with natural grass and artificial turf fields.
- 2) To discuss logistics in regards to Working Group and Committee reports, deliverables and project timeline.

Committee Members present: James DiTullio, Chair; Natasha Waden, Clerk; Leslie Mayer; Joseph Barr; Jill Krajewski; Marvin Lewiton; Claire Ricker; Joseph Connolly

Agenda

- I. Acceptance of Meeting Minutes

Motion to approve meeting minutes from 01/30/2024 was made by Leslie Mayer.

2nd by Jill Krajewski.

Vote:

Mike Gildesgame, Absent
Leslie Mayer, Yes
Joseph Barr, Yes
Jill Krajewski, Yes
Natasha Waden, Yes
Marvin Lewiton, Yes
James DiTullio, Yes

Approved (6-0 with 1 Absent)

- II. Correspondence Received

Natasha Waden reviewed correspondence received including 2 emails from Susan Chapnick and 1 email from Mike Gildesgame.

No additional discussion by Committee Members.

III. Guest Speaker (s)

a. Safety

i. Samantha Jones, Head Athletic Trainer, Arlington High School

Ms. Jones reported that the High School had 540 athletes during the fall sports season and currently has 489 for the winter season. Ms. Jones indicated that in her opinion the injury rate in Arlington between natural grass fields and artificial turf fields is about the same. Ms. Jones reported that the Athletic Training team saw a lot of ankle and knee injuries especially during the fall season among the soccer teams. Ms. Jones indicated that the type of surface does not necessarily matter when it comes to injuries. Injuries are based on a variety of factors including athletic ability, biomechanics, muscle mass, history of injuries and the circumstances that led to a specific injury (i.e. a player breaking a bone due to another player falling on them). Additionally Ms. Jones reported that the varsity teams play and practice exclusively on the artificial turf field, whereas the freshman and Junior Varsity teams utilize the grass fields, with occasional use of the artificial turf field.

Ms. Jones answered a variety of questions from Committee members including the following topics: 1) differences in injuries as it relates to male and female, indicating that knee injuries such as torn ACL's are more common among females due to hormones such as estrogen and basic body mechanic differences; 2) training of coaches, staff and athletes as it pertains to heat related illness/cold weather exposure, indicating that the Athletic Training team trains the coaching staff, and communicates to Athletes in writing (through team Captains) or in person (one on one or group/team discussion/s) about signs/symptoms and preventative measures associated with heat related illness and cold weather exposure; 3) heat related guidance/restrictions pertaining to both natural and artificial turf fields as well as surface temperature measurements, indicating that a Wet Bulb Globe Thermometer is used to test surface temperatures for both types of fields and restrictions are placed on the use of Artificial turf in hotter months and/or depending on the surface temperatures measured by the Wet Bulb Globe Thermometer (restrictions may include the length of time the field can be utilized by a team and hours of the day it can be used such as early morning or late afternoon/early evening; 4) surface temperature differences between natural grass and artificial turf fields, indicating that she has observed a 7-10 degree difference, with the artificial turf field temperature being higher due to how the field absorbs and reflects heat but that the wind can also help to reduce the surface temperature; 5) heat related injuries have been most concerning in the pre-season month of August and first couple of weeks in September, occasionally in Spring, but the athletic training team has not seen any significant heat related injuries, in part because the Athletic team ensures that modifications to practices are made and that the athletes have access to water, ice, cooling towels, shaded areas; 6) heat

acclimatization is used specifically for the football teams (required by MIAA) in August, as they practice in heavy equipment, this entails a 5 day period which gradually introduces the player to practicing in the heat with full padding on. For other teams, the trainers work to schedule practices in early morning or late afternoons whenever possible.

b. Environmental Group


- i. Dr. Helen Poynton, Associate Professor, School for the Environment, Umass Boston

Bio: <https://blogs.umb.edu/helenpoynton/>

Dr. Poynton was introduced by Joseph Barr, member of the Environmental working group, who was brought in to speak with the Committee about the impacts artificial turf and the chemicals associated with artificial turf have on the environment. Dr. Poynton explained that she is a Professor of Ecotoxicology and while she has studied lots of different pollutants, she could not recall specific studies directly associated with artificial turf, therefore she disclosed that the information she would be drawing on for this presentation would be from her research of peer reviewed articles/studies pertaining to artificial turf. The following power point presentation was shared and discussed with the Committee:

Environmental Health Considerations of Artificial Turf

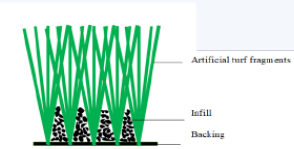
Helen Poynton
Professor of Ecotoxicology
University of Massachusetts Boston
School for the Environment



Overview

- What is artificial turf?
- Committee Questions

What is artificial turf?



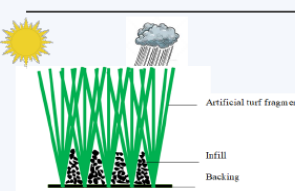
Turf fragments: Usually made of polyethylene plastic with PFAS chemical detected

Infill: tire crumb, other rubbers (EPDM, TPE), acrylic-coated sand, mineral and plant-based materials

Backing: polyester, polypropylene with urethane

Xie et al., 2022 Environ International 170:107663

What is artificial turf?



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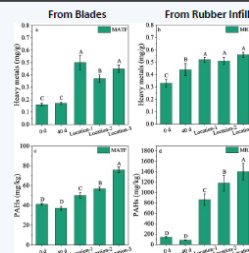
Transformation of chemicals and leaching into the environment: MATF and MRP

Xie et al., 2022 Environ International 170:107663

Most important chemicals for potential impacts to the environment, particularly on wildlife and aquatic organisms.



Actual use increases release of toxic pollutants



When fields are exposed to the sunlight and weather, they release more toxic chemicals than expected from lab studies.

Surprising is the levels of metals and polycyclic aromatic hydrocarbons (PAHs) in the plastic blades.

Leachates from both plastic blade particles and rubber infill decreased cell survival in an *in vitro* assay.

Xie et al., 2022 *Environ International* 170:107663

Effect of heat from artificial turf fields on wildlife

- Run-off from "hot" artificial turf fields could increase the water temperature in surrounding wetlands.
- Impacts: temperatures above tolerance limits of species and decreased dissolved oxygen.
- Impacts would be very site specific, how much run-off, where is it going, what are the characteristics of the area it is flowing into.

Is infill migration a concern for the environment?

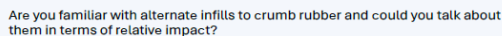
- European Union (Sept. 2023) banned products with "intentionally added microplastics" including "granular artificial turf infill." (Zuccaro et al. 2024)
- Leachate causes severe developmental toxicity in vertebrates (Xu et al. 2019).
- Generally agreed to the most harmful component for human and environmental health due to:
 - Microplastics
 - Metals (especially zinc)
 - 6PPD-quinone
 - PAHs

Xu et al. 2019, *PNAS* 116: 25156
Zuccaro et al. 2024, *Environ Sci Technol*. 58:2591.

At the request of a Committee Member, Dr. Poynton clarified to the Members that certain types of microplastics, such as ones used in hand soaps and facial soaps, have been banned by the Federal Government in the United States. Dr. Poynton indicated that the European Union has recently banned the use of all intentionally added microplastics which includes artificial turf infill.

At the request of a Committee Member, Dr. Poynton clarified that the chemicals of concern that are related to crumb rubber infill would be the 6PPD-Quinone, but also mentioned this would likely be found in other types of rubber infill material. Additionally, she clarified that some of the other chemicals would likely be found at higher levels in the crumb rubber than in the blades of grass.

At the request of a Committee Member, Dr. Poynton stated that there are a number of different infill alternatives to crumb rubber; however, there is very little research on it and so it would be difficult to say whether or not metals would be found in the alternative infill materials. Dr. Poynton did reference the TURI guidance document which does a comparison on different types of infill, including plant based infill, however there isn't a lot known about the products and whether or not preservatives have been added. She also indicated that there appears to be some evidence of an occupational hazard associated with dust inhalation associated with the plant based infill.



References:

PFOA/PFOS levels were high and issues related to reproductive issues and cancer cases were also more evident.

At the request of a Committee Member, Dr. Poynton discussed that collaboration between scientists and industry on ecotoxicology studies is common, but she could not speak to the specific components of artificial turf. In her opinion, regarding toxicology, Industries have not always been truthful in reporting their findings regarding their products and hazardous concerns.

IV. Discussion: Reports, Deliverables, Project Timeline

James DiTullio informed members that due to the upcoming President's Day Holiday, the deadline for bullet reports has been changed so that we are able to comply with Open Meeting Law. As such, reports are due by Thursday 2/15/2024 by 12noon and should be sent to Natasha Waden. Natasha reiterated that any additional material to be included in next week's packet will also need to be received by this time. The next deadline is for each group to submit their narrative report by Friday March 1st. Beyond that date, we may need to re-evaluate the project timeline

Next week's meeting we will spend the first hour hearing from a speaker who installs both Natural and Artificial Turf fields. The second half of the meeting will focus on the discussion of each working groups bullet reports, this discussion will also carry over to the February 27th Meeting. DiTullio advised Members that moving forward and as we get closer to the deadline, meetings may run longer and/or we may need to add additional weekly meetings in March.

DiTullio asked that all groups begin to send their references to Natasha regardless of whether or not you are citing it, reading it, or having discussions with individuals so that we can begin to draft the list of resources. Natasha asked that when sending references by email to use "AT References" in the subject line, so that they can be easily sorted by email.

V. New Business

A Committee Member inquired about whether or not, organizations/user groups other than high school have heat related guidance or training that is provided to coaches/athletes or families. Joseph Connelly agreed to reach out to the various groups to inquire about this and will follow up with the group.

VI. Adjourn

Motion to adjourn was made by Leslie Mayer.

2nd by Natasha Waden.

Vote:

Mike Gildesgame, Absent
Leslie Mayer, Yes
Joseph Barr, Yes

Jill Krajewski, Yes
Natasha Waden, Yes
Marvin Lewiton, Yes
James DiTullio, Yes

Approved (6-0, with 1 Absent)



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ARTIFICIAL TURF COMMITTEE MEETING COMMENTS FROM THE CHAT

Date: February 13, 2024

Time: 5PM

Location: Remote Participation

Susan Chapnick

27:39

SC

Does Sam think it would be helpful to reduction of injuries if the grass fields and/or artificial turf fields had better or more consistent maintenance?

Susan Chapnick

28:53

SC

What is the wet bulb temperature limit for restricting practice?

Susan Stamps

32:19

SS

When Sam says injuries on grass and turf fields are about the same? Does she mean the same number of ankle injuries, same number of knee injuries, etc? is the severity of the injuries the same?

Phil Lasker

59:57

PL

Related to natural infills...

Susan Chapnick

59:59

SC

Please address ecological hazards to these chemicals - in terms of invertebrates, other organisms

Phil Lasker

01:02:14

PL

Were those test results from the manufacturer prior to shipment? That's how current specifications are written since the fields can easily be contaminated from rain water.

Wynelle Evans

01:02:30

WE

Graham Peasley at Notre Dame, and others, have discussed the use of PFAS in the extrusion process when the blades are manufactured, thus its presence there

Phil Lasker

01:04:08

PL

I have numerous test results showing non-detect for PFAS from independent labs plus certifications from manufacturers. Specifications require PFAS and heavy metal testing prior to shipment. Arlington HS specs have this requirement.

Grant Cook

01:09:13

GC

Aren't we trying to move away from the most part from burning fossil fuels, versus overall fossil fuel usage?

Susan Chapnick

01:10:17

SC

Will Dr. Poynton's slides be available to the public?

Susan Stamps

01:11:01

SS

Can she show the last slide again please?

Grant Cook

01:12:21

GC

they might even be present in a piece of land that was used to say, bury garbage for years

Susan Chapnick

01:13:34

SC

It was a municipal landfill

Grant Cook

01:15:01

GC

Poet's was last tested when the church proposed building housing, I think 1990? It will have to be retested when that land gets sold depending on the proposed use, I suspect. You can find the test results online

Susan Chapnick

01:15:28

SC

You can get the testing results if the landfill was closed under MassDEP regulations. If they were capped, that is a "remedy" and leaching contaminants was measured under the MCP regulations otherwise the landfill would not be considered "closed"

Grant Cook

01:18:59

GC

Rt 2 was four lane undivided from the 30's.. it was turned into a freeway around 1970

Susan Chapnick

01:23:11

SC

MassDEP says that "some PFAS can accumulate in the food chain" [mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas](https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas)

Phil Lasker

01:25:40

PL

That's why the specifications for these fields require 3rd party independent testing.

Susan Chapnick

01:25:57

SC

Thank you Dr. Poynton - this was very informative!

Alex Bagnall

01:41:44

AB

Mass youth soccer has published heat rules

Phil Lasker

01:41:50

PL

Soccer follows MYSA

Alex Bagnall

01:41:58

AB

<https://www.mayouthsoccer.org/about/weather-policy/>

Phil Lasker

01:42:10

PL

Plus MIAA

Susan Stamps

01:42:39

SS

Thank you all for your hard work!

Joe Connelly - Recreation

01:42:57

JC

I have to go set up for Park and Rec, thanks everyone

Wynelle Evans

01:42:59

WE

Thanks to all

Arlington Artificial Turf Study Committee
Environmental Subgroup
DRAFT outline of report

While there is extensive information available regarding some of the environmental concerns of installing artificial turf versus natural turf fields, other aspects are less studied. The following are topics that we feel are essential and will be dealt with to the extent that time and information allow.

1. Wetland functions and values. What are the impacts of polluted runoff, impervious surface, and heat (also discussed further below) on wildlife and habitat in wetlands and buffer zones, and what are the differences between artificial fields versus natural grass on the ability of the resource areas and resource area buffers to provide for the wetlands functions including wildlife habitat, connectivity, water quality protection, etc.? We will review the Town's Bylaw and implementing Wetland Regulations regarding the protection of specific interests, collectively, "Resource Area Values" or "Interests of the Bylaw". Do artificial turf versus natural fields provide the protections listed in our Bylaw and implement Wetland Regulations? We expect to provide a summary of main concerns and recommendations.
 - The Town Bylaw and Wetlands Regulations protect "public or private water supply, ground water supply, flood control, erosion control and sedimentation control, storm damage prevention, other water damage prevention, prevention of pollution, protection of surrounding land and other homes or buildings, wildlife protection, plant or wildlife habitat, aquatic species and their habitats, and the natural character or recreational values of the wetland resources (collectively, "Resource Area Values" or "Interests of the Bylaw")." Recommend tabulating these Resource Area Values and then check boxes for artificial turf and natural turf in terms of offering protection to these values.
 - Consider also the environmental impact outside of wetland resource areas – where many of the same "values" are still important to the Town.
2. Runoff includes impacts of chemicals and particulates from infill migration including crumb rubber and other infills. We have not seen much, if anything, on the comparative impacts of new infills like processed coconut or walnut or some new combinations but there still remain the issues of plastic grass deterioration and other component and resulting microplastic and chemical impacts on wildlife and habitat health. We plan to look at these issues in comparison with management of natural turf fields. We will also try to consider the extent to which stormwater runoff impacts can be mitigated through stormwater management and treatment techniques. Note that increased pollution loads from runoff could include the following:
 - Chemicals = Metals (Zinc toxicity), Polyaromatic Hydrocarbons (carcinogens) and phthalates which are endocrine disruptors (aquatic toxicity), Volatile Organic Compounds (carcinogens and irritants), PFAS (found in several artificial turf components), 6ppd-quinone found in tire-crumb rubber infill (toxic to freshwater fish), Pesticides/Herbicides, Fertilizers, and disinfectants (used on Artificial fields)
 - Particulates = tire crumb rubber, micro and macroplastics from infill and from plastic grass blades due to wear / weathering)
3. Heat is a question for us as well as the health and safety subgroups. We will include reference to the Arlington climate resilience and hazard mitigation plans, both of which document the areas in Arlington where heat islands are an issue. There is TURI and other information on comparing with real turf.

- Urban Heat / Heat Islands / Hot Spots.
 - Artificial Turf surface temp measured ~ 150 degrees F vs. Natural Grass surface temp of ~ 90 degrees F when air temp = 90 degrees F; surface temperature is the applicable measurement for environmental considerations for wildlife (small mammals, birds, reptiles/amphibians, insects, other invertebrates) – note that “wet-bulb” temperature measurements are not applicable to the impacts on wildlife as they are measurements made at ~ 4ft above the surface.
 - Consideration of artificial field and natural fields as wildlife corridors in urban environments to connect open spaces for habitat
4. The larger context is climate change resilience and adaptation – do artificial turf or natural turf fields promote climate resilience and adaptation? The Arlington Bylaw and implementing Wetland Regulations require the “consideration of climate change adaptation planning to promote climate change resilience to protect and promote resource area values into the future. These considerations are especially important in Land Subject to Flooding (floodplain) and Riverfront Area and other Resource Areas which protect the interest of Flood Control and Storm Damage Prevention, including Adjacent Upland Resource Areas.”
 5. There is no verified evidence of any meaningful recycling of plastic turf or its components. Additionally, artificial turf fields must be replaced every 8 – 10 years, creating additive impacts over the expected life of an athletic field. We will explore how artificial fields and natural grass fields are consistent or inconsistent with other Arlington initiatives and goals towards green solutions, less reliance on fossil fuels, plastic reduction, urban heat reduction, and sustainability.
 6. We also may be able to look at issues of carbon sequestration and the importance of soil for wildlife etc.

Feb 14, 2024 draft

Safety Working Group

- Artificial turf (or synthetic turf, as it is also known) presents a series of questions about its use as a playing surface for both professional athletes and casual users.
- As part of this Committee's charge, we examined artificial turf's impact on player injuries (head injuries/concussions, tears/breaks/sprains, etc.), heat stress, and skin abrasions and bacteria infections. We have found that artificial turf has taken great leaps with respect to athlete and user safety over the last six decades, though even modern synthetic turf has notable limitations in comparison to professionally maintained natural turf fields, albeit limitations that can be managed or mitigated.

Injury

- Artificial turf has advanced from its early AstroTurf days, and that includes improvements in lowering player injuries.
- Recent studies on player injuries provide a mixed picture. While some studies still see a greater likelihood of sports injuries with artificial turf over grass, other studies see the two playing surfaces as equivalent with respect to injuries, and one recent study even saw an advantage to artificial turf fields.
- With the benefit of first-hand local experience on both natural grass and artificial turf with crumb rubber infill, Arlington High School's head athletic trainer has not seen any measurable difference in the type or number of injuries associated with playing surface. Some more frequent injury types are attributable to factors like differing physiology or player preparedness.
- In light of recent studies and research, it seems hard to definitively say whether modern artificial turf playing fields inherently present more risk of player injury than natural grass fields that are maintained to a professional standard. There seems to be a slightly higher risk of foot and ankle injuries on artificial turf fields versus natural grass fields, but the difference is not dramatic. And there is some indication that, with respect to certain sports injuries, artificial turf playing surfaces might be better than natural grass, including in the area of concussions.

Heat

- One area where there seems to be wide consensus is that artificial turf fields get hotter (and, in some cases, much hotter) in warm temperatures than natural grass fields. But there is nuance and complexity to the issue.
- Most reputable studies or analyses show that artificial turf fields with crumb rubber infill can get considerably hotter (sometimes as much as 80 degrees hotter) than natural turf on hot, sunny days.

- The heat-related concerns are very capable of being mitigated, especially in a community like Arlington that is in the New England climate.
- Heat-related concerns over artificial turf fields in New England would be most acute in the hottest months of the year (June, July, and August).
- For Arlington, installing new (or retaining existing) artificial turf fields of any kind should require closely monitoring of air and surface temperatures at those fields every day of their operation.
- If surface temperatures climb above a certain established level, then those fields should be closed to all uses for that day – much like natural grass fields are closed when rain or snow conditions prevent their use.
- For Arlington’s high school level athletic programs, local field conditions are regularly monitored by staff using wet-bulb temperature readings; during warm days in August, artificial turf temperatures tend to be 10 degrees warmer than natural grass.
- Arlington follows existing Massachusetts Interscholastic Athletic Association (MIAA) protocols related to practice and play during heat events and provides related training to coaches and team captains.
- Although there are a variety of alternative, organic infill materials, such as wood chips, coconut husks, cork, and BrockFILL, there is unfortunately very little published research relating to these materials’ ability to moderate the heat effects of artificial turf. Industry-reported data indicates that an alternative like BrockFILL, an engineered wood particle infill, may effectively control the worst heat effects associated with artificial turf, although it is debatable how much it can do so.

Skin/Bacteria

- Artificial turf fields raise the prospect of skin injury from high temperatures.
- There are mitigation measures to address those concerns, including signage directing users of the field to wear shoes at all times or limiting/closing the field to use on the hottest days of the year.
- Artificial turf fields also raise questions of bacteria infections, including greater prevalence of turf burns and skin abrasions compared to natural grass fields.
- But the threat of bacteria infections from artificial turf can be mitigated through good hygiene practices, such as washing skin abrasions with soap and water. Based on medical guidance, those who play on artificial turf surfaces should wash their hands before eating, drinking, or adjusting mouth guards, as well as cleaning cuts and abrasions immediately.

Health Working Group Outline

The Health Working Group is composed of the following Artificial Turf Study Committee Members: Marvin Lewiton, Jill Krajewski and Natasha Waden. This group identified the following three topic areas to study as it relates to both natural and artificial turf fields: 1) access to youth sports and its impact on mental and physical health; 2) heat impacts on human health as it pertains to field surfaces; and 3) health impacts associated with exposure to various chemicals associated with all natural and artificial turf playing fields. While our topic areas are listed from macro to micro, this does not indicate an order of importance or priority. We believe that each area should be considered and weighed individually in order to determine an overall decision.

TOPIC 1: ACCESS TO YOUTH SPORTS AND ITS IMPACT ON MENTAL AND PHYSICAL HEALTH

Exercise, and team sports in particular, improve the overall health of young people. Arlington should consider working on how to increase playing spaces to ensure equitable access to team sports for all its young residents. It should be considered that artificial turf may be uniquely positioned to allow for continuous play when adverse weather restricts play on natural grass fields.

- Participation in youth sports impacts many aspects of health.
 - Provides equitable access to youth programs that promote exercise and develop social interactions that occur as a part of a team.
 - Reduces risk of type 2 diabetes, obesity, cancer, depression, anxiety.
 - Lack of field space can limit enrollment and access to practice/playing times.
- Seasonal weather
 - Wet weather conditions limit access to grass fields during the busy season: (March 15- June 15 and August 15 - November 15).
 - Inability for users to utilize field in early months:
 - Artificial turf gives user access earlier, later in season, and potentially winter months depending on snow/ice etc.
 - Artificial turf doesn't require rest periods when rain occurs.

Gaps/limitations in research

- No direct research related to mental/physical health as it relates to access to artificial turf fields. Since this is an access issue and artificial turf might increase the access:
 - Will adding artificial turf fields increase access to playing times?
 - Will adding artificial turf fields increase youth sports enrollment?

Mitigation Measures

- Carefully selecting sites for artificial turf when/if they can increase access to youth town sports programs may be a benefit to the overall health of Arlington's youth.

TOPIC 2: HEAT IMPACTS ON HUMAN HEALTH

This may become an increasingly important issue as we continue to see the warming effects of climate change. The concerns are that artificial turf does have a higher heat load than natural grass. In addition, in all types of playing surfaces exposure to high heat levels has a cumulative effect on the human body. Children are more vulnerable to high temperatures than adults. For these reasons, education and mitigation are essential.

- Heat related illness
 - Cumulative effect - several days of heat exposure can be detrimental.
 - Lack of awareness by coaches and players of signs and symptoms of heat stress, appropriate remedial actions.
 - Need for gradual acclimatization in hot weather.
- Temperature difference between natural grass vs artificial turf fields, both surface and above surface, can lead to difference in heat stress for players, potential for burns; including local data from the High School Athletic trainer.
- Impact of color of infill and fiber on temperature.

Gaps/limitations in research

- Comparison of days lost to rain within spring (March 15 - June 15) and fall (August 15 - Nov 15) season as compared to loss of days for high heat/humidity.
 - Which has a greater impact?
- Challenges in accurately assessing air temperature above field (wet bulb), how is this measurement done by various organizations other than the high school Athletic Department.
- What is currently done for heat impact training for sports coaches that are not governed by the MIAA?

Mitigation Measures

- Implement guidelines/restrictions for use of both grass and Artificial Turf during periods of high heat/humidity. The MIAA may be a good place to reference.
- Ensure acclimatization schedule for players in hot weather.
- Raise awareness of heat related illness for coaches/parents/players:
 - Ensure acclimatization schedule for players in hot weather.
 - Train coaches in recognizing signs and appropriate responses to heat strain.
 - Provide heat-related illness resources to families that participate in youth sport.
 - Could possibly be a requirement through issuance of permits through the Arlington Recreation Department.
- Proposals for artificial turf should have built-in mitigations for heat reduction such as shade structures and reflective infill color; where possible grass fields should include heat mitigations as well.

TOPIC 3: CHEMICAL EXPOSURE

We know that artificial turf and its infills contain a wide variety of hazardous chemicals. What is not known at this point is how much exposure results from playing on these surfaces. In general, reducing exposure to hazardous materials has a positive health effect. One way to do this is to opt for PFAS free turf carpet and to move away from crumb rubber and continue to research safer infills.

- Routes of exposure:
 - Ingestion.
 - Inhalation.
 - Dermal.
 - “Take home” exposures.
- Health Concerns
 - Toxicity risk.
 - Carcinogen risk.
 - Endocrine disruption risk.
 - Reproductive system risk.
- Chemicals of concern:
 - Major route of exposure is ingestion, also inhalation.
 - PAHs - polycyclic aromatic hydrocarbons.
 - PFAS - fluorinated carbon compounds; thousands of types:
 - Major route of exposure is ingestion, also inhalation.
 - Limits are set for drinking water.
 - Arlington’s drinking water comes from MWRA.
 - No limits have been set for inhalation or absorption.
 - Phthalates - plasticizers.
 - Microplastics.
 - Heavy metals.
- Cumulative effects of these chemicals have adverse effects on human health. This is a particular concern for the chemicals that have not been clearly regulated or which exposure levels other than water have not been established.
- Effects of potential exposure on different age groups
 - Toddler - 5yr old.
 - Elementary.
 - Middle School and above.
- Comparison of infill materials
 - Crumb rubber infill.
 - Rubber alternative infills.
 - Acrylic sand infills.

- Organic infill material.

Gaps/limitations in research

- Limitations in personal sampling methods, analytical methods for exposure.
- Very little research on alternative infill materials.
- Very little research on exposure to turf components (blades, backing).
- Most research is cancer focused:
 - However, no cancer clusters as a result of artificial turf have been identified.
 - No research on the effects of multiple compounds.
 - Little research on non-cancer or other health outcomes (eg. endocrine disruption).

Mitigation Measures

- Discontinue the use of tire crumb rubber in future projects and opt for safer alternatives.
- Conduct pre-installation testing of field materials to ensure they are PFAS free.
- Since the major route of entry of PFAS and phthalates is ingestion, consider which age groups are best suited to be scheduled on turf fields.